In *Terinos taxiles*, the lower disco-cellular nervure meets the median nervure *a little before* the base of its second branch.

In *Terinos teuthras*, the lower disco-cellular nervure meets the median nervure *at the base* of its second branch.

In *Terinos tethys*, the lower disco-cellular nervure meets the median nervure *a little beyond* the base of its second branch.

3. On the Red Corpuscles of the Blood of Vertebrata, and on the Zoological Import of the Nucleus, with Plans of their Structure, Form, and Size (on a Uniform Scale), in many of the different Orders. By George Gulliver, F.R.S., Professor of Comparative Anatomy and Physiology to the Royal College of Surgeons.

The object of this communication is to give a summary of the value and import of the red corpuscles of the blood as regards systematic zoology, deduced from my observations published, piecemeal, during the last twenty-three years, in the 'Proceedings' of this Society and elsewhere. Such notices will be given of the labours of others in this interesting field, up to the year 1845, as the present confused state of physiological history may seem most to require.

The drawings now exhibited to the Society are selected from a much larger number in my possession, and are all on the same scale, exhibiting plainly to the eye the relative form and size of the corpuscles in 171 species of the different classes and orders of the Vertebrate subkingdom, and the difference of structure in the corpuscles of the two great divisions of this subkingdom—*i. e.*, 1, *Vertebrata apyrenæmata*, or Mammalia; 2, *Vertebrata pyrenæmata*, or Oviparous Vertebrata.

Structure of the Corpuscles of Apyrenæmatous Vertebrates.

In Man and other Mammalia there are two sets of red corpuscles. The first or temporary set disappears at an early period of intrauterine life, and is replaced by the second or permanent set.

The corpuscle of the temporary set is composed of a vesicle including a nucleus, is larger than the corpuscle of the second set, and is, in short, a cell containing a nucleus. This cell is, both in structure and size, the true analogue of the red corpuscle of oviparous Vertebrata. (See Phil. Mag. for Aug., 1842, p. 107; and my Note to Wagner's Physiology, Lond., 1844, p. 242, fig. 148.)

The corpuscles of the second set are those which replace the first set, and, subject to waste and supply, are the red corpuscles of the blood from birth, and during the greater part of the period of utero-gestation, until death; and to these corpuscles the following observations will always be applied, unless otherwise expressed.

This corpuscle is not homogeneous, but is composed of a colourless membranous part, with a semifluid or viscid matter in which

the colour resides; and this matter, which forms the chief bulk of the corpuscle, is very soluble in water, while the membranous part is insoluble in water. The corpuscle is slippery, soft, elastic, and viscid; it will assume a variety of forms, and quickly return to its regular shape; and the corpuscles will stick together, not only in the well-known piles, but also by their edges. Dr. Hodgkin and Mr. Lister noticed the viscidity of the part of the corpuscles which had been ruptured by pressure; but Dr. Davy first clearly described the general viscidity of the entire corpuscles, which has been confirmed by the recent observations of Dr. Charles Robin, who appears to have been unacquainted with the observations just mentioned, so long before made in this country. I have observed that this viscidity of the corpuscles is much increased in buffy blood.

The regular corpuscle has no nucleus—nothing at all like that so plain in the corpuscle of oviparous Vertebrata. Even the oval corpuscle of Camelidæ has the true Mammalian type, both in size and structure, being of the small size usual to Ruminantia, and alike destitute of a nucleus; so that it is in shape only that these corpuscles resemble those of the inferior classes, as proved by me long since in the papers cited below. And as the history of what, in 1845, Mr. Wharton Jones appropriately called "this vexed question of a nucleus" is interesting and important in physiological literature, and seems never to have been clearly known, we may dwell a little on the subject.

The mistake of describing a nucleus in the red corpuscle of Mammalia arose from its central spot, and from the observers having seen the nucleus so plainly in the larger corpuscles of fishes and reptiles. Thus Hewson, using the corpuscles of the Skate to ascertain their structure, never entertained a doubt that the nucleus he saw so plainly —"like a pea in a bladder"—in the red corpuscle of that fish was a true representative of a nucleus in the human blood-corpuscle, and, indeed, that what was true of the structure of the one was equally so of the other.

And this error, in one shape or other, prevailed up to our time, and was quite general about the year 1839, when I was always endeavouring to correct it (see Med. Ch. Trans. vol. xxiii.; Lancet, 1840–41, p. 101; and my App. to Gerber's Anatomy, p. 13); while Müller, Krause, Gerber, and others, following Prevost and Dumas and Prof. Milne-Edwards on the Continent, had satisfied themselves of the existence of a nucleus in the human blood-corpuscle; and the late Dr. Martin Barry was publishing engravings in the 'Philosophical Transactions,' in London, of what he regarded as positive proofs of this so-called nucleus. But it must be recollected that in 1827 Dr. Hodgkin and Mr. Lister made the following statement:—"Our observations are at variance with the opinion long since formed by Hewson, that these particles consisted of a central globule inclosed in a vesicle composed of the coloured part; and which, though refuted by Dr. Young, has since in a modified form been revived by Sir Everard Home and Bauer in this country, and by Prevost and Dumas on the Continent." This conclusion of Dr. Hodgkin and Mr. Lister refers to their examination of the human blood-corpuscles; and most in-

teresting it is, among the first anatomical fruits of Mr. Lister's very important labours in the improvement of the microscope, and withal so accurate that it ought at once and for ever to have dispelled any further belief in this imaginary nucleus of the blood-disc of Man. Yet, after all, it does not appear that their observations were pushed far enough to verify the remarkable exactness of Hewson's description regarding the oviparous Vertebrata, but only to show its inaccuracy when applied to Mammalia. And so here we were left to the distraction of half-truths, that fruitful source of error, very precise and conscientious in themselves, but still so confounding two things fundamentally different as to obscure the whole truth. This, indeed, as in so many other cases, lay between both parties; for the descriptions of Hewson and of Hodgkin and Lister are quite accurate and real, when confined, as they ought always to be, to the class of animal on the blood of which those excellent observers were severally engaged.

Lastly, in 1842 and 1845 Mr. Wharton Jones in England, and M. Donné on the Continent, fully coincided with me as to the difference in question between the Mammalia and the lower Vertebrata; and this essential fact as to the "vexed question of a nucleus" was then established evermore, though in 1841 Dr. Rees and Mr. Lane were still maintaining that there really is a nucleus in the blood-disc of Man. But their supposed nucleus seems to be identical with what I have always depicted and described as the membranous base or frame of the corpuscle, and similar to the part figured by Home and Bauer, but a very different thing from a nucleus.

Now, if we wash the red corpuscles of Mammalia in water, using a tall narrow jar or even a test-tube, allowing them to subside, decanting the supernatant liquid, and adding fresh portions of it until all the colouring-matter and viscid part be removed, there will be a whitish precipitate, consisting mostly of pale, thin, nearly transparent, flattened circular discs. These are the membranous bases or frames of the corpuscles—corresponding to the globuline of some authors—quite insoluble in water, and so faint as not to be easily seen until their opacity has been increased by some such reagent as corrosive sublimate, which makes them very distinct. In short, this washed corpuscle is its colourless tegumentary frame, which, thus treated, is finer and smaller than (that is to say, about two-thirds the diameter of) the fresh unwashed corpuscle, thinner and of larger comparative diameter than the nucleus of the blood-disc of oviparous Vertebrata, and approaching in size to, but wanting the globular form of, the objects represented in the beautiful drawings by Bauer:—

Fig. 1. Outlines of the human corpuscle, the first and second as seen flat and on edge; and the third showing the thin, delicate, faint and colourless membranous frame or base of the same, and entirely devoid of a nucleus, after three days washing in water. At fig. 12 is seen, first, a sketch of a regular corpuscle of a bird, and next, the same corpuscle made round, and clearly showing its nucleus after similar washing in water. This washed corpuscle is represented rather larger than it should be.

Shape of the Red Corpuscles of Apyrenæmatous Vertebrates.

The red corpuscle is a circular, flattened, biconcave disc, rounded at the margin. The flatness of the corpuscle was first clearly proved by Hewson,—though the old error of its spherical or spheroidal figure prevailed for years afterwards, and was particularly supported by Mr. Hunter. The biconcave form was inferred by Dr. Young, and proved by Dr. Hodgkin and Mr. Lister. This concavity causes the central spot so long mistaken for a nucleus.

There are certain exceptions, regular and irregular, to the circular and biconcave shape. The *Camelidæ*, as will be more particularly explained in the proper place, have oval corpuscles. And when we consider how pliant and elastic the Mammalian corpuscle is, and what a delicate endosmometer it may be, how it will be taking in and giving out fluid according to the relative density of the liquor sanguinis and contents of the corpuscle, we might expect rapid variations in its shape within certain limits; and such is the fact.

Accordingly, the corpuscles may be either swollen, puckered, or shrunk into a variety of figures, flat, tumid, like a shallow circular or oval cup, stellate, notched, granulated, mulberry-shaped, crescentic, angular, lanceolate, fusiform, comma-shaped, and other figures, defying definition. In certain *Cervidæ*, to be noticed presently, the angular, crescentic, and lanceolate corpuscles are in unusual abundance. Dr. Richardson has well depicted a number of forms presented by the corpuscles in connexion with disease.

Relative Sizes of the Red Corpuscles of Apyrenæmatous Vertebrates.

The knowledge of this subject was very vague before my observations. It was the prevailing statement, after Hewson, that the size of the corpuscle is not at all connected with that of the animal, since he found them alike in the ox, cat, ass, mouse, and bat. But, while confirming the accuracy of his statement as to animals of such different orders, I soon found that, in a really natural family, *other things equal*, the largest corpuscles will be generally found among the large species, and the smallest corpuscles among the small species, of that family. See, for examples, the drawings of the corpuscles of Rodentia and Edentata, orders characterized by large corpuscles; and those of Ruminantia, an order, on the other hand, characterized by small corpuscles. There are many exceptions to an exact relation between the sizes of the species and corpuscles; but these will probably fall into order as our knowledge extends. In the Ass, for instance, the corpuscles are slightly larger than in the Horse, as might be expected from the comparative muscular and respiratory activity of these two animals; in the Mouse and the gigantic Rat the corpuscles scarcely differ in size; in the Noctule they are just appreciably smaller than in some of the more diminutive Bats. To enumerate the exceptions, which are commonly but slight, would be tedious and unnecessary, as some of them may be seen in the woodcuts, and numerous others, as well as those just mentioned, in my 'Tables of Measurements,' published in the 'Proceedings' of this

Society, October 14, 1845, and in subsequent numbers; in the Appendix to the English version of Gerber's 'Anatomy;' and in my 'Notes to the Edition of Hewson's Works,' printed for the Sydenham Society. The exceptions among the Feræ were long since especially noticed by me; and exceptions among aberrant species of any family may be generally expected. But no example has hitherto been discovered (*cæteris paribus*) of any one natural family, subject to the exceptions implied, in which the largest corpuscles do not prevail among the large species, and the smallest corpuscles among the small species of that family. And this is the way in which I have put or intended the rule as to the relation between the size of the corpuscles and that of the species in the higher Vertebrata. But I never extended it to the two lowest classes, as may be seen from my measurements of their corpuscles, and in the papers just cited. On the contrary, some of the great Ophidia, as *Python*, are there shown to have smaller corpuscles than such little species as *Coluber* and *Anguis*. And this seems to be sufficient notice of the so-called exceptions of certain reptiles and fishes erroneously adduced, in a former Part of the 'Proceedings' of this Society, against my observations.

As to the comparative smallness and abundance of the corpuscles of the Tunny, if, as there is reason to suppose, this be a warm-blooded fish, the fact would be interesting as a probable indication of a special adaptation. Dr. Davy, the highest authority on this question, has long since proved experimentally that its ally (the Bonito) has warm blood, and that the blood of the Tunny is so very rich in red corpuscles as to afford a remarkable contrast in this respect to some of the cold fishes with which he made the comparisons. I long since perceived that there must be some sort of connexion between the size of the red corpuscles and the respiratory function; and Dr. Davy in 1844 held, as the result of precise observations, that these corpuscles are important in relation to animal heat. They have long been considered as carriers of oxygen. More recently, Professor Milne-Edwards, in his excellent 'Leçons sur la Physiologie,' has made this subject his own as far as concerns the tendency of the red corpuscles to be of smaller size in proportion to the general activity and respiratory demands of the animal, and *vice versâ*. His observations are numerous and interesting on this point; and the many exceptions as to regular gradation of size, such as may be seen in the present woodcut, and, further, in the 'Tables of Measurements' already referred to, are fairly recognized by him. But our knowledge is not at present sufficiently advanced to admit of a calculation of the disturbing circumstances, of which hybernation and peculiarities of structure and habits, and differences in the relative proportion of the red corpuscles to the other proximate constituents of the blood, may be among the number.

In Mammalia and Birds I have long since observed some tendency to a relation of size between the red corpuscles and pulmonary air-cells and capillary vessels. And when the beautiful observations of the late Professor Quekett showed the value and import of the bone-cells, it was immediately seen that there is a like disposition to a re-

lation between these and the red corpuscles. In short, *cæteris paribus*, the higher the organization of the animal, the greater is the quantity and surface of the red corpuscles, and *vice versâ*. The sum of this surface of a given quantity will be increased in proportion to their minuteness, and diminished in proportion to their largeness, just as the surface of a pound of lead would be much greater in small than in large shot.

Man.—But few Mammalia have larger corpuscles than Man; among these may be noted the elephant, the whale, the great ant-eater.

Quadrumana.—The corpuscles differ but little from those of Man, being only just appreciably, or sometimes not at all, smaller, both in the monkeys of the old and new continents. In the lemurs the corpuscles are slightly smaller generally.

Cheiroptera and Insectivorous Feræ.—The corpuscles are slightly smaller than in the monkeys.

Feræ.—There is considerable diversity in the size of the corpuscles, but such a marked disposition to uniformity in those of certain subdivisions of the order, that some of them might be distinguished from others by a comparison simply of the corpuscles. Some of the small *Felidæ* have rather larger corpuscles than the lion or tiger. If set down in the order of the size of the corpuscles, from large to small, the families would stand thus:—seals, dogs, bears, weasels, cats, viverras. A *Viverra* may be instantly known, by the smallness of the red corpuscles, from a dog. In the seals, otters, and dogs the corpuscles are about as large as in Man, and those of the viverras as small as in some little species of Ruminantia. *Bassaris* has been alternately associated with the bears and viverras; as far as regards its corpuscles it agrees best with the bears. The Kinkajou in the same respect approaches more to the viverras than to the bears and weasels with which it has at different times been arranged.

Pachydermata.—As discovered by Mandl, the elephant has corpuscles larger than those of Man; in the rhinoceros they are rather smaller than in Man, and still smaller in the tapirs, pigs, and horse. In *Hyrax* the corpuscles are enlarged again; so that in this respect this animal is more like a rodent than a pachyderm. Indeed, it may be expected that, whenever a marked difference exists in the corpuscles of any species as compared with the corpuscles of its nearest allies, that species will prove to be an aberrant one—*Cercoleptes*, *Bassaris*, *Hyrax*, for example.

Cetacea.—In *Balæna* the corpuscles are slightly larger than in Man, and rather smaller in the porpoise, with an intermediate size in the ca'ing whale.

Ruminantia.—An order characterized by the smallness of the corpuscles. In the Napu musk deer, meminna, and Stanley musk deer I discovered* that the red corpuscles are the smallest known in the animal kingdom, and that those of the brocket deer and the *Ibex* are next in minuteness. Then follows a further enlargement

* See Med. Chir. Trans. vol. xxiii.; Dublin Medical Press, Nov. 27, 1839; and the Lancet, vol. ii. p. 101, 1840–41.

in the corpuscles of the common goat, which had always been previously described as the smallest known. In the sheep they are somewhat larger still; while in the large species of the order, as the Buffalo and Aurochs, the Sambur, Wapiti and Moose-deer, the corpuscles are as large as in many Carnivora, and larger than in most of the *Viverridæ*.

In certain *Cervidæ*, as the Mexican, Reeve's, and the Hog Deer, the crescentic, lanceolate, and fusiform shapes may occur in great abundance, as shown in the woodcut.

The *Camelidæ* have oval blood-corpuscles. But, as I proved in 1839 (see foot-note, page 97) and often since, it is in shape only that these red corpuscles resemble those of oviparous Vertebrata. The corpuscles generally of the *Camelidæ* have no nucleus, and so agree in structure, as they do also in size, with those of their mammalian allies. The oval shape of the corpuscles was discovered by Mandl in the Dromedary and Paco, quickly afterwards confirmed and found by me to exist also in the Bactrian Camel, the Llama, and the Vicugna.

Rodentia.—These have large corpuscles, like those of the Quadrumana. Even in that tiny creature the Harvest-mouse they are quite as large as in the Horse and Peccary, while in the Capybara they are as large as or larger than in Man. In some of the small active *Sciuridæ*, besides the large corpuscles, there was an unusual proportion of smaller ones, which might be curiously considered in connexion with the habits of this family.

Edentata.—The corpuscles are large; in the Armadillo hardly smaller than in Man, while they are larger in the Two-toed Sloth and in the Great Ant-eater. The corpuscles of these two last-named animals are the largest known among Mammalia, excepting the Elephant; and it may be supposed, according to the rule already explained, that the red corpuscles of the gigantic *Glyptodon* and *Megatherium* were larger than any yet seen in the class.

Marsupiata.—The corpuscles agree in structure with those of the corresponding placental series of animals, and generally approach in size to those of the Rodentia.

Monotremata.—The corpuscles of the *Ornithorynchus* are very like those of Man in all respects, according to the observations of Drs. Davy, Hobson, and Bedford; and my examination of the blood of the *Echidna* was to the same effect.

Red Corpuscles of Pyrencematous Vertebrates.

Hewson's description, when confined exclusively to these, is so remarkably accurate as to require little addition as regards structure. The regular red corpuscle of oviparous Vertebrata is a cell or vesicle containing a nucleus, while the regular red corpuscle of Mammalia has no nucleus. This is the leading or central difference, as resulting entirely from my own observations, between these two great subdivisions of the Vertebrata; and thus we long since disposed of "this vexed question of a nucleus." Compare figs. 1 and 12, and the description of them at page 102.

Birds.—The vesicle, when treated with water, so far from retaining its shape or becoming narrower, as erroneously represented by Professor Kölliker, becomes generally more or less round in this and the lower classes; and so do the oval corpuscles of the camels.

No bird has yet been found with the majority of the corpuscles otherwise than oval. In any drop of blood a few of them may be more or less circular; but their most common figure is with the short diameter as 1 to the long diameter between $1\frac{1}{2}$ and 2. Still they vary in different species, so as to present the form of a broader or narrower ellipse. The broad short shape is frequent in some little granivorous and insectivorous birds, as the Rice-bird; and the narrow long shape in several birds of different orders, as the Snowy Owl, Passenger Pigeon, and Butcher-bird. The thickness of the corpuscle is between a third and a fourth of its short diameter.

As might be expected from their comparative uniformity of organization, in birds the size of the corpuscle is much less variable than in Mammalia, and has throughout the class so far more relation to the size of the species, whether of one or different orders, that Hewson would scarcely have said of this class that the corpuscles are not disposed to be larger in the large than in the small species. In short, no instance is yet known, *cæteris paribus*, of a prevalence of the largest corpuscles in the small and the smallest corpuscles in the large birds, taking a great number of the different-sized species to compensate for aberrations; so that the whole class resembles in this respect a single order of Mammalia, and is alike without an exact or regular gradation in the size of the corpuscles, the rule applying only with many exceptions, as before noticed or implied. The Hornbill, for example, has larger corpuscles than some much larger birds, as the Pelican.

A very remarkable relation exists between the short diameter of the oval corpuscles of birds and the diameter of the circular corpuscles of Mammalia. Indeed, so constant is this coincidence that it may be accepted as a rule. I have not met with an example in which the breadth of a bird's corpuscle does not closely correspond to the diameter of the corpuscle of some of the Mammalia.

Reptiles.—In structure and shape the corpuscles of reptiles are the same as in birds; but in size the reptilian corpuscles vary so greatly as to afford a remarkable contrast in this respect with birds. The largest occur in the naked amphibia, especially in the perennibranchiate subdivision, as discovered by Professor Wagner; and the smallest in the lizards, tortoises, and serpents. Such is their magnitude in the *Proteus*, that they may be seen with a common hand-lens; and the observation of Dr. Crisp, which accords with my subsequent examinations of them in the fresh blood, shows that they are nearly as large in the great Japanese Salamander. In that paradoxical creature *Lepidosiren*, I found that the corpuscles have the true reptilian character, being larger than those yet known of any fish, and having also a stronger and more durable vesicle than that of the blood-corpuscle generally of fishes; and Dr. Gray (a very

high authority on a question of zoological affinity) has recently arranged this animal among the reptiles.

Fishes.—The structure of the corpuscle is the same as in the two preceding classes. The vesicle in fishes is usually more tender and evanescent. There are great variations in the size and shape of the corpuscles, as discovered by Professor Wagner, especially in the cartilaginous group. They are largest and oval in the Sharks and Skates, and circular in certain Cyclostomes, as *Ammocœtes* and *Petromyzon*, in which the corpuscles are among the smallest—the discovery also of Wagner. Their large size in the Common Skate was discovered by Hewson. In the Pike I found them generally more or less pointed at the ends, though in many other osseous fishes the corpuscles are more or less regularly oval, and similar in size to those of birds, yet with the disc commonly broader in comparison with its length. It may be nearly or quite circular; and often at least half of the corpuscles are thus round, especially a few hours after death, so that the short ellipse is almost displaced by the circular form, as may be seen in the blood of the Tench.

The most aberrant corpuscles in the class, as might be expected, occur in Mr. Yarrell's Lancelot (*Amphioxus lanceolatus*), in which, according to the observations of Retzius, Quatrefages, and Müller, they are colourless, like lymph-globules and the blood-corpuscles of numerous Invertebrata. But it must be recollected that this creature is ranked as the lowest fish by Yarrell, and was in fact described by Pallas as a Limax. Professor Kölliker assures us that there are no blood-corpuscles whatever in this fish! It has been found on our shores; and whoever may take up a systematic investigation of the blood-corpuscles of the Invertebrata must either begin or end with *Amphioxus*, as their connecting link with the Vertebrata. In the Glutinous Hag, Müller found the corpuscles oval, and even fusiform.

Zoological Import of the Nucleus.

In Mammalia we have shown that, during an early period of intra-uterine life, the temporary red blood-cell with its nucleus is the analogue of the permanent or common red corpuscle of oviparous Vertebrata, while the permanent or common red corpuscle of Mammalia is devoid of any such nucleus.

To the cursory observer it might seem of little consequence whether the red corpuscles of the blood of Man and Mammalia have, or have not, a nucleus; and accordingly, up to this moment, the question seems to have been commonly regarded as a mere microscopical curiosity. But when, in 1839 and again two or three years afterwards, I fully saw the essential difference in question between these corpuscles and those of oviparous Vertebrata (having proved the fact by careful examinations of the blood of numberless animals, and that in opposition to the then prevailing erroneous statements and doctrines), it at once appeared to me as a very essential truth; and subsequent experience has only confirmed this view. In short, the fact of this structure of the corpuscles of the two great divisions

of Vertebrata, comprehending such a wide extent of subordinate facts as to rise to all the dignity of a central one, small as it may appear, is really a great addition to zoological science. Thus is plainly unfolded the most universal and essential difference ever before discovered between the Mammalia and oviparous Vertebrata; for this one minute point is in truth so large and extensive as to clearly characterize the divisions in question in any sex or at any age, which not one of the old diagnoses can effect. Yet not even a glimpse of this important truth, so readily reconciling the discrepancies of former observers, was ever caught, during the contentions as to the presence or absence of the nucleus, in this zoological point of view.

And the present conclusion is alike extended and supported by the discoveries of development for which we are indebted to Mr. Wharton Jones, who has clearly shown that there is a similar difference in this respect. But although his important researches ought to have been well known in this country since 1845, they have been strangely neglected, while the far less accurate and comprehensive observations of Professor Kölliker have been imported and translated, and much too generally adopted in England. In connexion with Mr. Wharton Jones's conclusion, I may mention that one, two, three, or four mammalian red corpuscles may certainly form a nucleus of a cell, as depicted by me in the 'Philosophical Magazine,' Sept. 1842, p. 170. This observation has often since been imported from abroad, but never with the least perception of its significance.

And so "this vexed question of a nucleus" is at length not only settled, but also placed at the service of systematic zoology. Accordingly, the two great divisions of the Vertebrate subkingdom are here characterized as *Vertebrata pyrenæmata* and *Vertebrata apyrenæmata*—the former corresponding to the oviparous, and the latter to the Mammalian section.

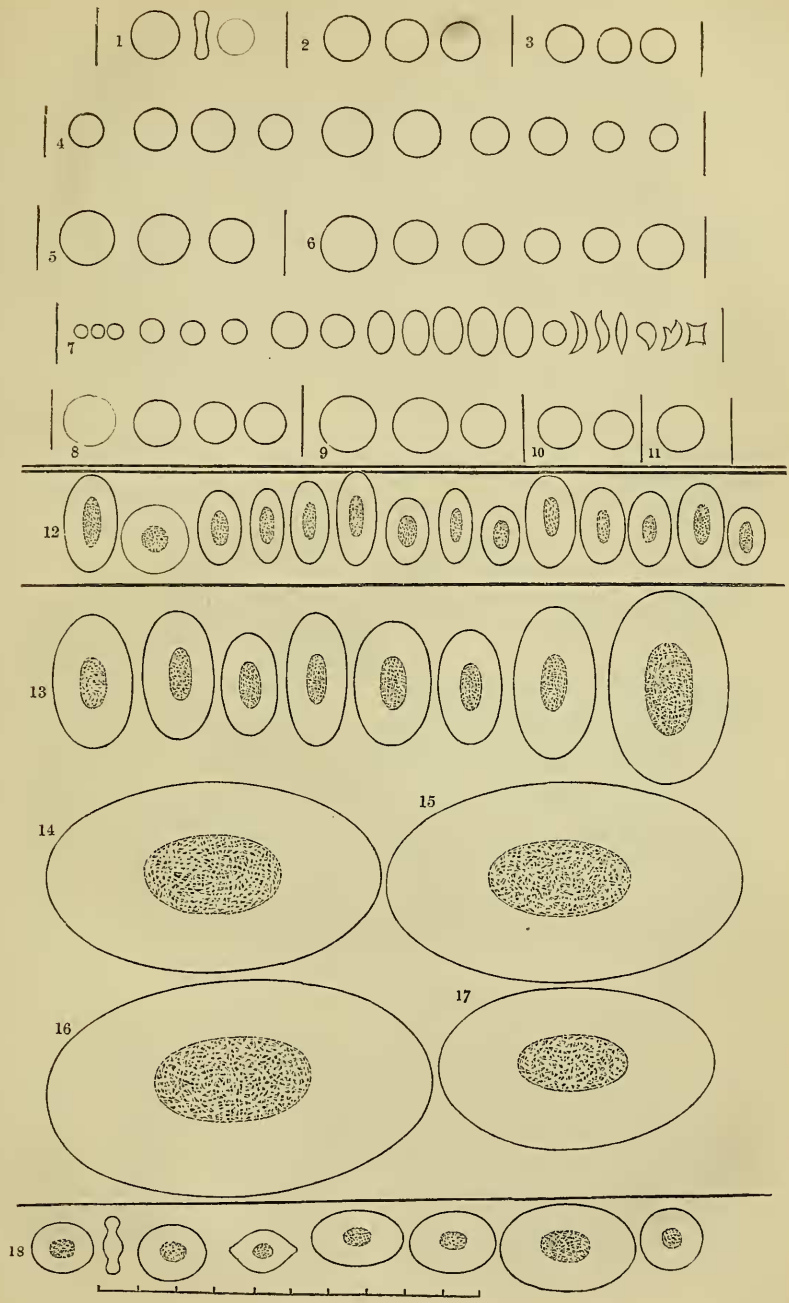
DESCRIPTION OF THE WOOD ENGRAVING (p. 101).

All the corpuscles are drawn to a scale of $\frac{1}{4000}$th of an English inch, and are magnified about 920 times linear admeasurement. The scale is marked at the bottom of the engraving.

Corpuscles only of average size are given; and but one corpuscle from each species of animal, with the few exceptions presently to be noticed.

The corpuscles of Apyrenæmatous Vertebrates occupy the upper part of the engraving, above the double line; and the different orders of these are separated by the short upright lines. The corpuscles of Pyrenæmatous Vertebrates occupy all the larger part of the engraving below the double line. At 12 is a row of birds' corpuscles; 13–17, corpuscles of reptiles; and 18, a row of the corpuscles of fishes. The figures at 1 and 12, referring to structure, are fully explained at page 93. Of the Pyrenæmatous Vertebrates, the nuclei are shown much more plainly than they appear in the pure corpuscles; but the action of acetic acid exposes the nuclei as distinctly as they are here represented.

The names of the animals are set down in the following table, according to the order in which the sketches of the corpuscles stand in the engraving. The following measurements of the corpuscles are all in vulgar fractions of an English inch; but as the numerator is invariably 1, it is omitted throughout, and the denominators only are printed. T. denotes the thickness, L. D. the long diameter, and S. D. the short diameter of the corpuscles.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Vertebrata apyrenæmata.

Figs. 1. *Homo.*

Corpuscle flat	3,200
The same on edge, T.	12,400
The same, long macerated in water	4,800

Figs. 2. *Quadrumana.*

Simia troglodytes	3,412
Ateles ater	3,602
Lemur anjuanensis	4,003

Figs. 3. *Cheiroptera.*

Vespertilio murinus	4,175
—— noctula	4,404
—— pipistrellus	4,324

Figs. 4. *Feræ.*

Sorex tetragonurus	4,571
Ursus labiatus	3,728
Bassaris astuta	4,033
Cercoleptes caudivolvulus	4,573
Phoca vitulina	3,281
Canis dingo	3,395
Mustela zorilla	4,270
Felis tigris	4,206
Paradoxurus pallasii	5,485
—— bondar	5,693

Figs. 5. *Cetacea.*

Balæna boops	3,099
Delphinus globiceps	3,200
—— phocæna	3,829

Figs. 6. *Pachydermata.*

Elephas indicus	2,745
Rhinoceros indicus	3,765
Tapirus indicus	4,000
Equus caballus	4,600
T.	13,422
Dicotyles torquatus	4,490
Hyrax capensis	3,308

Figs. 7. *Ruminantia.*

Moschus javanicus		12,325
—— meminna		12,325
—— stanleyanus		10,825
Cervus nemorivagus		7,060
Capra caucasica		7,045
—— hircus		6,366
Bos urus		4,074
Camelopardalis giraffa		4,571
Auchenia vicugna	L. D.	3,555
	S. D.	6,444
—— paco	L. D.	3,361
	S. D.	6,294
—— glama	L. D.	3,361
	S. D.	6,294
Camelus dromedarius	L. D.	3,254
	S. D.	5,921
	T.	15,337
—— bactrianus	L. D.	3,123
	S. D.	5,876
	T.	15,210

Cervus mexicanus: the seven last corpuscles—round, crescentic, sigmoid, lanceolate, comma-shaped, notched, and quadrangular forms.

Figs. 8. *Rodentia.*

Hydrochœrus capybara	3,190
Castor fiber	3,325
Sciurus cinereus	4,000
Mus messorius	4,268

Figs. 9. *Edentata.*

Myrmecophaga jubata	2,769
Bradypus didactylus	2,865
Dasypus villosus	3,315

Figs. 10. *Marsupiata.*

Phascolomys wombat	3,456
Hypsiprymnus setosus	4,000

Fig. 11. *Monotremata.*

Echidna hystrix	3,300

Vertebrata pyrenæmata.

Figs. 12. *Aves.*

	L. D.	S. D.
Struthio camelus	1,649	3,000
T.	9,166	
Nucleus	3,200	9,166
(With a corpuscle after maceration in water.)		
Vanga destructor	2,019	3,892
Lanius excubitor	1,989	5,325
Bubo virginianus	1,837	4,000
Surnia nyctea	1,555	4,042
Nucleus	3,200	10,666
Columba rufina	2,314	3,429
—— migratoria	1,909	4,626
Dolychonyx oryzivorus	2,400	4,167
Buceros rhinoceros	1,690	3,230
Psittacus augustus	2,085	3,600
Phasianus superbus	2,128	3,587
Nucleus	4,500	8,000
Pelecanus onocrotalus	1,777	3,369
Nucleus	3,200	9,600
Trochilus ——	2,666	4,000
(Species unknown.)		

Figs. 13–17. *Reptilia.*

	L. D.	S. D.
Gymnopodus ægyptiacus	1,143	2,000
Crocodilus acutus	1,231	2,286
T.	8,000	
Lacerta viridis	1,555	2,743
Anguis fragilis	1,178	2,666
Coluber berus	1,274	1,800
Nucleus	3,227	4,986
Python tigris	1,440	2,400
Nucleus	3,555	7,468
Bufo vulgaris	1,043	2,000
T.	5,625	
Nucleus	2,802	5,261
Lissotriton punctatus	814	1,246
Nucleus	1,778	2,667
Fig. 14. Sieboldia maxima	450	800
Fig. 15. Siren lacertina.	420	760
Nucleus	1,142	2,007
Fig. 16. Proteus anguinus	400	727
Fig. 17. Lepidosiren annectens	570	941
Nucleus	1,455	2,900

Figs. 18. *Pisces.*

Perca cernua	2,461	3,000
The same on edge, T.	8830	
Nucleus	6,000	8,000
Cyprinus tinca	2,286	2,722
T.	8,830	
Nucleus	8,500	9,600
Esox lucius	2,000	3,555
Nucleus	5,333	8,000
Thymallus vulgaris	1,684	2,900
Gymnotus electricus	1,745	2,599
Squalus acanthias	1,143	1,684
Ammocœtes branchialis	2,460	

March 11, 1862.

Dr. Gray, V.P., in the Chair.

Mr. W. H. Flower, F.R.C.S., F.L.S., Conservator of the Museum of the Royal College of Surgeons, read a memoir on the Brain of the Javan Loris (*Stenops javanicus*).

The subject of this communication was an adult female, which died in the Zoological Society's Gardens in January, 1862. In the examination of the brain every care had been taken to preserve the natural configuration of the different portions of the organ; the drawing of the upper surface had been made before its removal from the cranial cavity, and the other drawings, descriptions, and measurements were checked by comparison with a cast of the interior of the skull. The value of the descriptions and figures of the brain of *Stenops* already published had been much diminished by inattention to such precautions; and they had also had the disadvantage of being made before the researches of Gratiolet had thrown light upon the arrangement of the convolutions on the cerebral hemispheres of the higher Quadrumana. A new description, which may serve as a standard of comparison in studying the cerebral anatomy of allied forms, seemed therefore to be called for.

The following is an abstract of Mr. Flower's remarks:—

"When seen *in situ*, the two hemispheres present together an oval figure, 1·3 inch in length, and 1·05 inch across the broadest part, which is situated at the junction of the middle and posterior third of the long axis. From this point the oval gradually narrows to rather a sharp apex in front. There is no appearance of that want of symmetry, both of size and form in the two hemispheres, described and figured by Vrolik. Projecting anteriorly to the extent of $\frac{1}{5}$ inch beyond the cerebral hemispheres are the olfactory lobes, of consider-